ADV 6899

FINAL
PHASE II (a) FIELD SAMPLING PLAN FOR MORTAR TARGETS

OF THE
CAMP EDWARDS IMPACT AREA GROUNDWATER QUALITY STUDY

MASSACHUSETTS MILITARY RESERVATION
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Prepared for

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MMR-0552

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Final Phase II (a) Mortar Targets FSP

1.0 Introduction

This Field Sampling Plan (FSP) was prepared in accordance with the approved Final Workplan for Phase II (a) Activities (Ogden, 1999a). The mortar targets that are the subject of this FSP were identified by EPA as part of the locations to be investigated in Phase II (a) of the Impact Area Groundwater Study (IAGS). The mortar targets are located in the southwest portion of the Impact Area, in the area northeast of Succonsette Pond. Although the targets in this area have also been used for artillery fire, the phrase "mortar targets" is used in light of their proximity to the mortar firing positions on the southwest side of the Impact Area, and the probability that most mortar fire is directed at these targets. The 11 mortar targets considered in this FSP are on a list of 30 targets maintained by Range Control, that were used for artillery and mortar fire until the recent cease fire order by EPA. The remaining 19 targets are primarily located along Tank Alley east of Turpentine Road, with a few along Turpentine Road north of Tank Alley, as indicated in the Final FSP for Gun and Mortar Positions (Ogden, 1998a).

A draft version of this FSP was provided to the regulatory agencies for review in October 1999. Comments on this FSP were received from EPA and MADEP, and responses to comments submitted in November 1999. The comments and responses are included in Attachment D of this FSP.

1.1 Description of Mortar Targets

Between August 16 and 27, 1999, a field reconnaissance of 11 mortar targets was conducted in the portion of the Impact Area bound by Pocasset Sandwich, Wheelock, and Turpentine Roads. On November 10, 1999 a field reconnaissance of the potential targets along Turpentine Road was conducted. Also on November 10, second field reconnaissance of three of the mortar targets was conducted to determine the existence of 40 mm HE rounds. Coordinates of mortar targets were derived from maps and lists maintained by Range Control (see Attachment A). The coordinates derived from the Range Control list were entered into a hand-held Global Positioning System (GPS) unit and used in the field to locate the targets. Once located, the targets were photographed and the target and surrounding area were described in a field log book.

The targets consisting of tanks, armored personnel carriers (APCs), and buoys are in the relatively flat area south of MW-25, between Turpentine and Pocasset Sandwich Roads, as indicated in Figure 1. MW-25 is adjacent to one of the targets. The flat area is bounded to the southwest by a steep side of the kettle hole containing Succonsette Pond. This entire area is heavily cratered. The craters lack vegetation. Training rounds cover much of the ground surface. Trench-like depressions (ranging in length from a few feet to several meters and approximately one to two feet in width) and several uncratered areas lacking vegetation were observed in the area as well. The mortar targets also appear to have been fired on by artillery, considering the presence of many craters over five feet in diameter, and the types of training rounds observed in the area. An inventory of munitions observed in the vicinity of each target will be prepared during subsequent investigations as described in Section 2.

Within this area, 11 targets were identified on the list and map provided by Range Control (Attachment A). One of the targets could not be located. During the first reconnaissance, two of the targets were in an area heavily covered with 40mm grenades making them too hazardous to approach without removal of vegetation for visual identification of UXO. Due to the lack of vegetation during the second field reconnaissance, visual observation of the areas around these targets determined that only 40 mm training grenades existed on the ground surface. Each of the 11 target locations is summarized in Table 1 and described below.

Table 1 also includes four potential targets that were identified by aerial reconnaissance. These locations along the southern end of Turpentine Road were not identified as targets by Range Control. They include two scrap cars, a steel box, and some truck frames. Each of these locations is also described below.

Table 1. Mortar Target Types and Locations

Target #	Target Type	Target Coordinates	Photo #	Area #
1	Buoy	70 32 18.608 41 42 37.170	1	80
2	Tank (not found)	70 32 24.339 41 42 40.083	None	
3	Tank	70 32 32.499 41 42 38.189	2	81
4	APC	70 32 38.422 41 42 35.081	3	82
5	Buoy	70 32 41.628 41 42 35.810	4	83
6	APC	70 32 42.744 41 42 34.061	5	84
7	APC	70 32 48.038 41 42 32.119	6	85
8	APC (not observed)	70 32 57.022 41 42 34.741	None	86
9	Buoy	70 32 52.991 41 42 28.185	7	87
10	Buoy	70 32 52.554 41 42 28.477	7	88
11	APC	70 32 54.691 41 42 25.466	8	89

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Table 1. Mortar Target Types and Locations				
Target #	**Target Type**	**Target Coordinates**	**Photo #**	**Area #**
	Car		10	
	Steel box		11	
	Truck Frames		12	

Target 1: Buoy

The target has heavy damage from projectiles. The entire area is cratered and covered with munitions. The buoy is approximately 8 feet in diameter (Photograph 1).

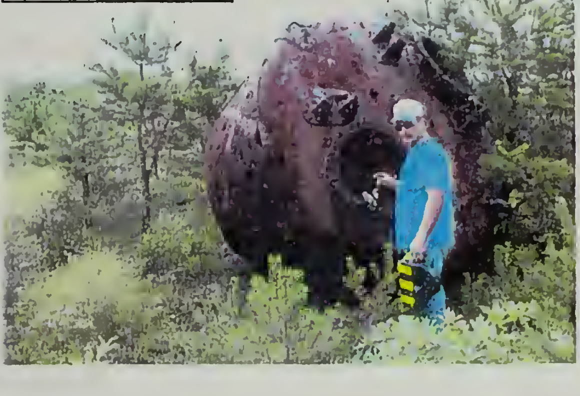
Target 2: Tank

This target could not be located. However, a reconnaissance of the area where the tank was thought to be located is heavily damaged by projectile impacts.

Target 3: Tank

This target is located adjacent to MW-25. It has apparently been hit many times by projectiles. The entire area is heavily cratered and covered with munitions. The tank is approximately 10 feet long and 8 feet wide (Photograph 2).

Photograph 1



Photograph 2

Target 4: APC

The APC is severely damaged. There is little vegetation in the craters. Munitions cover the area. The APC is approximately 15 feet long and 8 feet wide (Photograph 3).

Target 5: Buoy

The target has heavy damage from projectiles. The entire area is cratered and covered with munitions. The buoy is approximately 8 feet in diameter (Photograph 4).

Photograph 3

Photograph 4

Target 6: APC

The target has heavy damage from projectiles. The entire area is cratered and covered with munitions. The inside of the APC contains many mortar rounds. There are many areas lacking vegetation in the vicinity. The APC is approximately 15 feet long and 8 feet wide (Photograph 5).

Target 7: APC

This target has been heavily hit. The entire area has craters over 5 feet in diameter. The craters lack vegetation. The APC is approximately 15 feet long and 8 feet wide (Photograph 6).

Photograph 5

Photograph 6

Target 8: APC

This target was not approached due to the hazard posed by 40mm grenades covering the area. It was not visible from the nearest accessible area.

Targets 9 and 10: Buoys

There were many 40mm training grenades here. The area was heavily cratered and lacking vegetation present in the surrounding area. These buoys are approximately 10 feet in diameter (Photograph 7).

Target 11: APC

This target is south of Targets 9 and 10 where many 40mm training grenades were scattered about the ground. The target had evidence of being hit by many rounds other than the 40 mm training rounds. The area 100 feet from the target was heavily cratered and contained training rounds (Photograph 8).

Potential Targets Along Turpentine Road

The site field reconnaissance conducted on November 10, 1999 along Turpentine Road located the four potential targets observed from aerial reconnaissance. The northern most object was identified as an old car (Photograph 9) which showed no evidence of it being used as a target. The area around the car was heavily vegetated with no impact craters in the area.

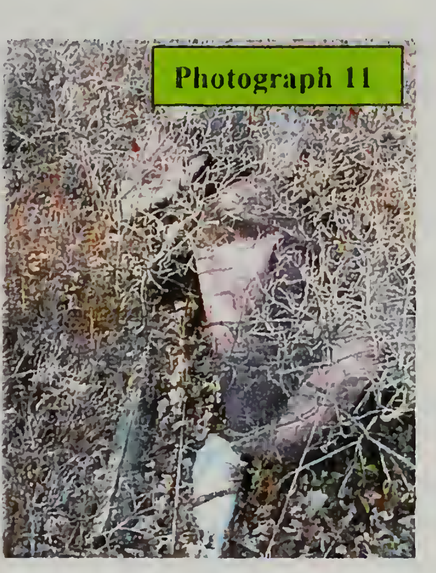
Photograph 7

Photograph 8

The next object located approximately 500 feet to the south and directly adjacent to Turpentine Road was another car (Photograph 10). The car had several 81mm mortar fins and some flare tubes placed on the top. There was no evidence that the car was used as a target. The area around the car was very heavily vegetated. The next object located further to the south was a large crushed steel refrigerator box (Photograph 11) with no evidence of it being used as a target. The area around the steel box was heavily vegetated and showed no evidence of training activities. The southern most object observed was what appeared to be several truck frames (Photograph 12). Both the truck frames and the surrounding area showed no evidence that it was used as a target.

Photograph 9

Photograph 10


Photograph 11

Photograph 12

2.0 Proposed Soil Investigation

Soil investigations will be preceded by UXO clearance. The clearance activity will consist of preparing an inventory of all visible munitions within the soil sampling grids, and flagging magnetic anomalies. The flagged locations will be avoided during subsurface soil sampling.

2.1 Sampling Locations

Soil sampling will be conducted beginning in the area immediately surrounding each target. Contaminant concentrations are expected to be highest in these areas. Samples will be arranged in concentric rings around each target, so that contaminant concentrations at varying distances can be determined. If contaminants are detected at the furthest distance sampled, additional sampling will be proposed for these targets. Target 2 (not found) and the objects located along Turpentine Road will not be sampled.

Two rings of samples will be placed around each target, as indicated in Figure 2. The radii of the rings will be dependent upon the dimensions of the target. Table 2 summarizes the estimated dimensions of each type of target and its proposed sample rings. The size of the rings may be adjusted in the field based on a target's actual dimensions and the ability to perform magnetic surveys for possible UXO at steel tank locations.

Table 2. Target Dimensions and Sample Ring Size			
Target Type	**Target Dimensions**	**Radius of Inner Ring**	**Radius of Outer Ring**
Tank	24 x 12'	15	25
Bouy	10' diameter	10	20
APC	18 x 8'	10	20

Each ring will have 8 evenly distributed subsamples separately homogenized and four points where discrete samples are taken, split into two subsamples, one used for the ring composite and the other analyzed as a discrete sample. Each of the subsamples in a ring will be composited to provide one concentration of possible contaminants in soil of equal distance from the target. The discrete samples will be located where the north, south, east and west axes of the target intersect the rings. Soil sampling for Target 3 has already been proposed in the Phase II (a) Workplan (Ogden, 1999a), and no additional sampling is proposed for this location.

In addition to the ring grids around each target, discrete soil samples will be collected at certain targets where the soil surface beneath the target is accessible. These samples will be collected by the UXO Contractor considering that magnetometers will not be effective for UXO avoidance in close proximity to the large steel targets. The Guard and regulatory agencies will identify locations for these samples after UXO surveys of the area around each target. It is expected that approximately 6 discrete samples will be collected from beneath overhangs at tank and APC targets.

2.3 Sampling & Analysis Methods for Soils

The sampling intervals will be 0-3, 3-6, and 6-12 inches below ground surface (bgs). Additional sampling at depth will be dependent upon the results of the surface soil samples and will be discussed with the USEPA and MADEP on a case by case basis.. Soil subsamples will be wetted using deionized water as needed to prevent observable dust emissions during the composite mixing process.

Sample collection will be consistent with MMR SOPs, the Ogden Health and Safety Guidelines, Attachment B: Field guide to High Explosives, Attachment C: Soil Sampling Protocol, and the ASTM Standard Guide for Composite Sampling and Field Subsampling for Environmental Waste Management Activities (October 31, 1996). Sampling rings will be flagged for magnetic anomalies prior to sampling, and sampling points adjusted if necessary to avoid anomalies. EPA Method 8330 will be used to analyze all samples. Composite samples will also be analyzed for all Phase I analytes, except for VOCs which will be collected as a discrete sample as described in Attachment C.

The following protocol will be followed for soil sampling:

1. A 0-3" soil sample will be collected from each of the eight sample points in a ring using the method described in Attachment C, resulting in eight subsamples per ring;
2. Each subsample will be homogenized (wetting as needed to prevent dust emission), and if necessary to collect a discrete sample, split into two subsamples in accordance with Section 8.1 of the ASTM Standard Guide and Attachment B of this FSP, resulting in eight pairs of subsamples;
3. The subsample or split from each point will be combined with the other subsamples or splits in the ring in equal amounts to comprise a single composite sample, in accordance with Section 8.1 of the ASTM Standard Guide and Attachment B of this FSP. Discrete subsamples will also be submitted for analysis.
4. Repeat steps 2-3 above for the 3-6" depth interval, then for the 6-12" depth interval for each ring.

In addition to field samples, QA/QC samples will be collected as described in the QA/QC Plan (Ogden, 1999b). These include field duplicates at the rate of 10% (rounded to the next whole number) of the field samples, trip blanks at the rate of 1 per day per sampling crew, field blanks at the rate of one per sampling event per water source, and equipment rinsates at the rate of 1 per day.

3.0 Proposed Groundwater Investigation

Monitoring wells MW-9, MW-15, and MW-25 are located downgradient from mortar targets and are each screened at the top of the water table. MW-25S has had a detection of RDX as indicated in the draft Completion of Work Report (Ogden, 1998b). MW-25S is located 60 feet from Target 3 and is screened at the water table, as indicated in the Phase II (a) Workplan (Ogden, 1999a). MW-9S has not had explosives detected. MW-9S is located west (downgradient) of the mortar targets and is screened at the water table. Groundwater profiling was not conducted at MW-9S or –25S.

Well nest MW-15S/D is also located downgradient of the mortar targets, southwest of MW-9S. A total of 24 profile samples were collected at MW-15 during Phase I of the IAGS, starting at the water table to a depth of 230 ft below the water table (bwt). The explosive compounds 1,3-dinitrobenzene, 1,3,5-trinitrobenzene, 3-nitrotoluene, 4-nitrotoluene, and picric acid were detected in profile samples from 0 to 50 and 170 to 230 ft bwt. These five compounds are often reported to be false positives based upon photo diode array (PDA) review of other profile sample locations. PDA review was not available at the time of analysis for the profile samples at MW-15, during Phase I.

Two monitoring wells have been completed at the MW-15 location. MW-15S was completed at the water table, and MW-15D was completed at a depth of about 220 ft bwt. Neither monitoring well has had detectable levels of explosives and both wells have been sampled twice. It appears from the monitoring well results that the profile detections of explosive compounds at MW-15 were false positives and are not indicative of contaminants emanating from upgradient mortar targets.

Because contaminants appear at greater depths in the aquifer as distance from the source increases, profiling of the top 100` feet of the water table near and downgradient from the mortar targets is proposed to better characterize the possible impact of the mortar targets. Figure 1 shows the tentative well locations at PMT-1 and PMT-2. Three well screens will be installed at each location based on groundwater profile sample results. The location of PMT-1 is downgradient from the mortar targets, to maximize the probability of detecting broadly distributed contamination if it originates from within the mortar target locations. The location of PMT-2 is closer to the mortar targets, to maximize the probability of detecting low concentrations of contaminants that may not be measureable downgradient. The well locations will be finalized based on the results of the soil investigation. The Guard will review the results of soil and groundwater samples with the EPA and MADEP. The Guard may propose additional groundwater monitoring wells based on the review of the soil and groundwater results.

Monitoring wells will be installed per the Final FSP for Barber Rig Drilling Investigation (Ogden, 1997) as well as Section 4 of the Action Plan (ETA, 1997). The boring will have downhole UXO clearance. Soil lithology will be logged using cuttings from the cyclone. Sample collection will be consistent with MMR SOPs and the Ogden Health and Safety Guidelines.

Groundwater profile samples will be collected as close as possible to the water table and every ten feet below the water table, during advancement of the boring. The boring will be extended approximately 100 feet into the water table. The estimated water table depth at the well location is 115 feet below ground surface. Profile samples will be collected in accordance with Sampling Protocol C.2, outlined in Section 4.2.2 of the Action Plan

(ETA, 1997). Profile samples will be submitted for laboratory analysis of explosives (EPA Method 8330, specify 1-day rush) and VOCs (CLP Method OC21V, specify 1-day rush). Once the monitoring wells are completed and developed they will be sampled for the complete analyte suite used during Phase I.

4.0 Sample Identification

4.1 Groundwater Profile Samples

Profiling samples will be uniquely identified with an Ogden sample ID that contains a reference to the sample location (well number) and the sample depth. The following is an example of the sample ID:

GP0099M1A

The sample ID is broken down in the following example, to describe each of the components:

GP - 0099 - AA - A

GP	Indicates that the sample being collected is a groundwater profiling sample.
0099	Indicates the boring number from which the sample was collected. Final boring numbers for PMT-1 and PMT-2 will be assigned at the time of drilling.
AA	Indicates the depth from which the sample was collected. Leading letter "A" will indicate the first groundwater sample collected from the water table or immediately below the water table. Each subsequent 10-foot interval, will be the next consecutive letter. For instance a sample from 30 feet below the water table would be designated using "DA". If water cannot be recovered from a sample interval, the letter to designate that interval is not used. If water is collected from the next 10-foot interval, the next consecutive letter would be used.
A	Indicates the type of sample.

A	Original Sample
D	Duplicate Sample
E	Equipment Rinsate
F	Field Blank
T	Trip Blank

For example, GP0099MAD is a groundwater profiling duplicate sample from MW-99, from 120' below water table.

4.2 Soil Samples

Soil samples may be collected from borings depending on PID field screening results. Samples will be uniquely identified with an Ogden sample ID similar to the above for groundwater profile samples, except that the first two characters are "SB" rather than "GP". Also, the depth character will be "AA" for the first sample (regardless of depth), "BA" for the second sample, etc.

Soil samples from rings or grab samples, collected by hand as described in Attachment C, will be uniquely identified with an Ogden sample ID similar to the above for groundwater profile samples, except that the first two characters are "HC" for composite samples and "HD" for discrete samples. The 4-digit boring number is entered as follows:

- The first two digits are the area number = 80-89 for mortar targets (see Table 1)
- The next character denotes grid location = "A" for inner ring, and "B" for outer ring
- The next digit denotes subsample location = 1 for composite sample and 1-8 for discrete samples (1 is north, 2 is northeast, 3 is east, 4 is southeast, 5 is south, etc.)

The 2-character depth designation is similar to the above for groundwater profile samples, where "AA" is the first depth (0-3 inches bgs), "BA" is the second depth (3-6 inches bgs), and "CA" is the third depth (6-12 inches bgs).

5.0 References

ETA, 1997. Final Action Plan for the Camp Edwards Impact Area Groundwater Quality Study. Prepared for the National Guard Bureau, Arlington VA, by Engineering Technologies Associates, Inc., Ellicott City MD, July 1997.

Ogden, 1997. Final Field Sampling Plan for Barber Rig Drilling Investigation of the Camp Edwards Impact Area Groundwater Quality Study. Prepared for the National Guard Bureau, Arlington VA, by Ogden Environmental and Energy Services, Westford MA, July 18, 1997.

Ogden, 1998a. Final Field Sampling Plan for Gun and Mortar Positions of the Camp

Edwards Impact Area Groundwater Quality Study. Prepared for the National Guard Bureau, Arlington VA, by Ogden Environmental and Energy Services, Westford MA, 02/09/98.

Ogden, 1998b. Draft Completion of Work Report for the Camp Edwards Impact Area Groundwater Quality Study. Prepared for the National Guard Bureau, Arlington VA, by Ogden Environmental and Energy Services, Westford MA, 7/1/98.

Ogden, 1999a. Final Workplan for Phase II (a) Activities of the Camp Edwards Impact Area Groundwater Quality Study. Prepared for the National Guard Bureau, Arlington VA, by Ogden Environmental and Energy Services, Westford MA, July 21, 1999.

Ogden, 1999b. Quality Assurance/Quality Control Plan Revision 3 of the Camp Edwards Impact Area Groundwater Quality Study. Prepared for the National Guard Bureau, Arlington VA, by Ogden Environmental and Energy Services, Westford MA, 04/14/99.

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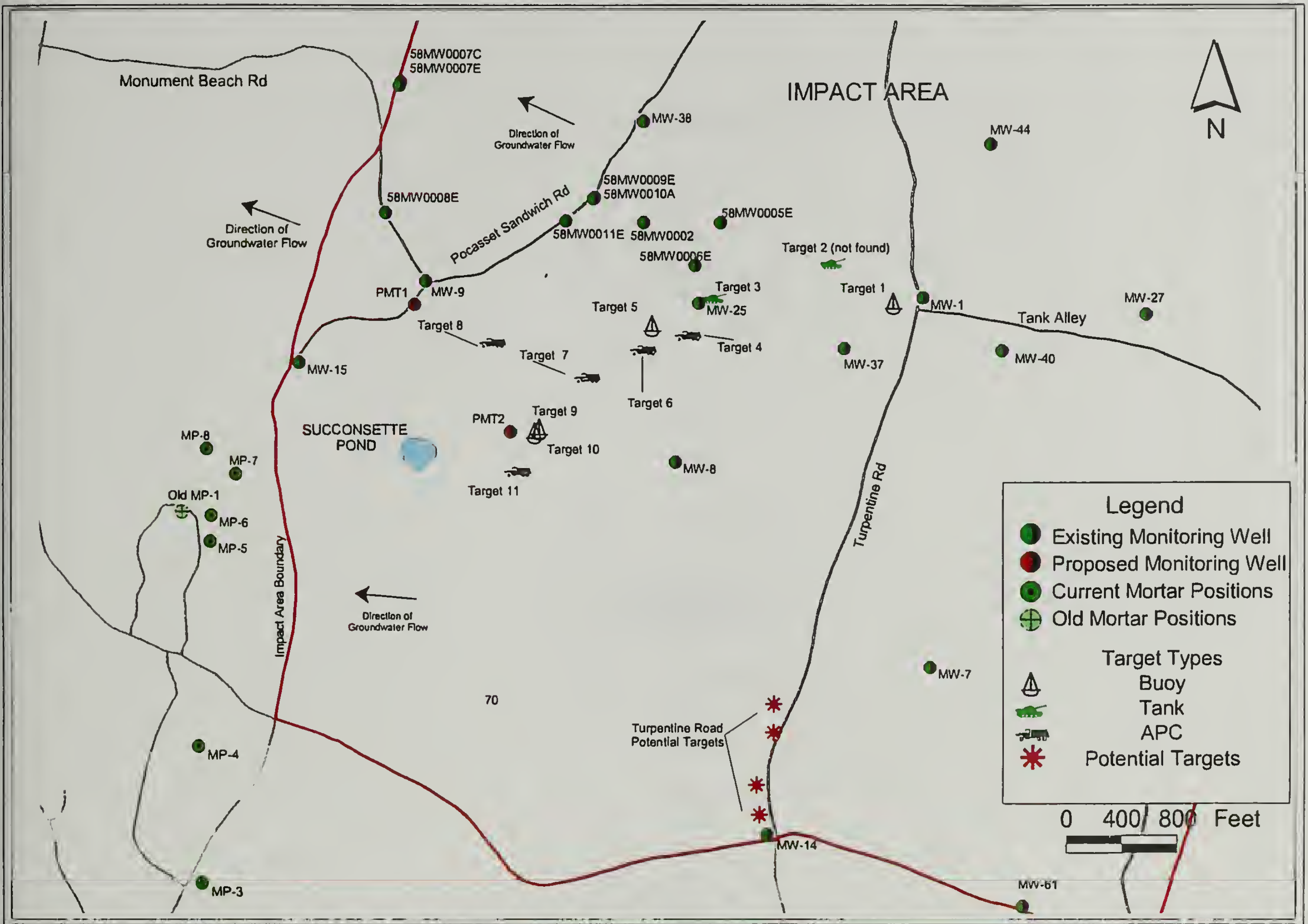
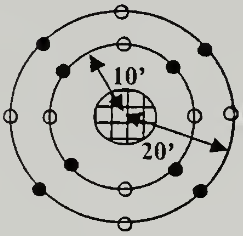


Figure 1
Locations of Mortar Targets

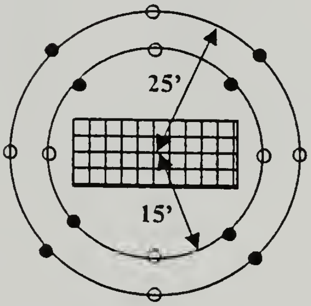
L:/MMR/GIS/November99/Locations of Targets
G:/MMR/jen info coords.apr/Locations of Targets
Update November 18, 1999

Figure 2
Mortar Target Rings

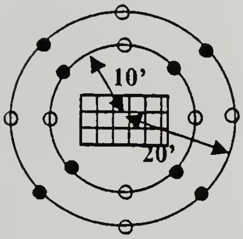
Buoy
8-foot diameter



Tank
24 x 12'



APC
16 x 8'

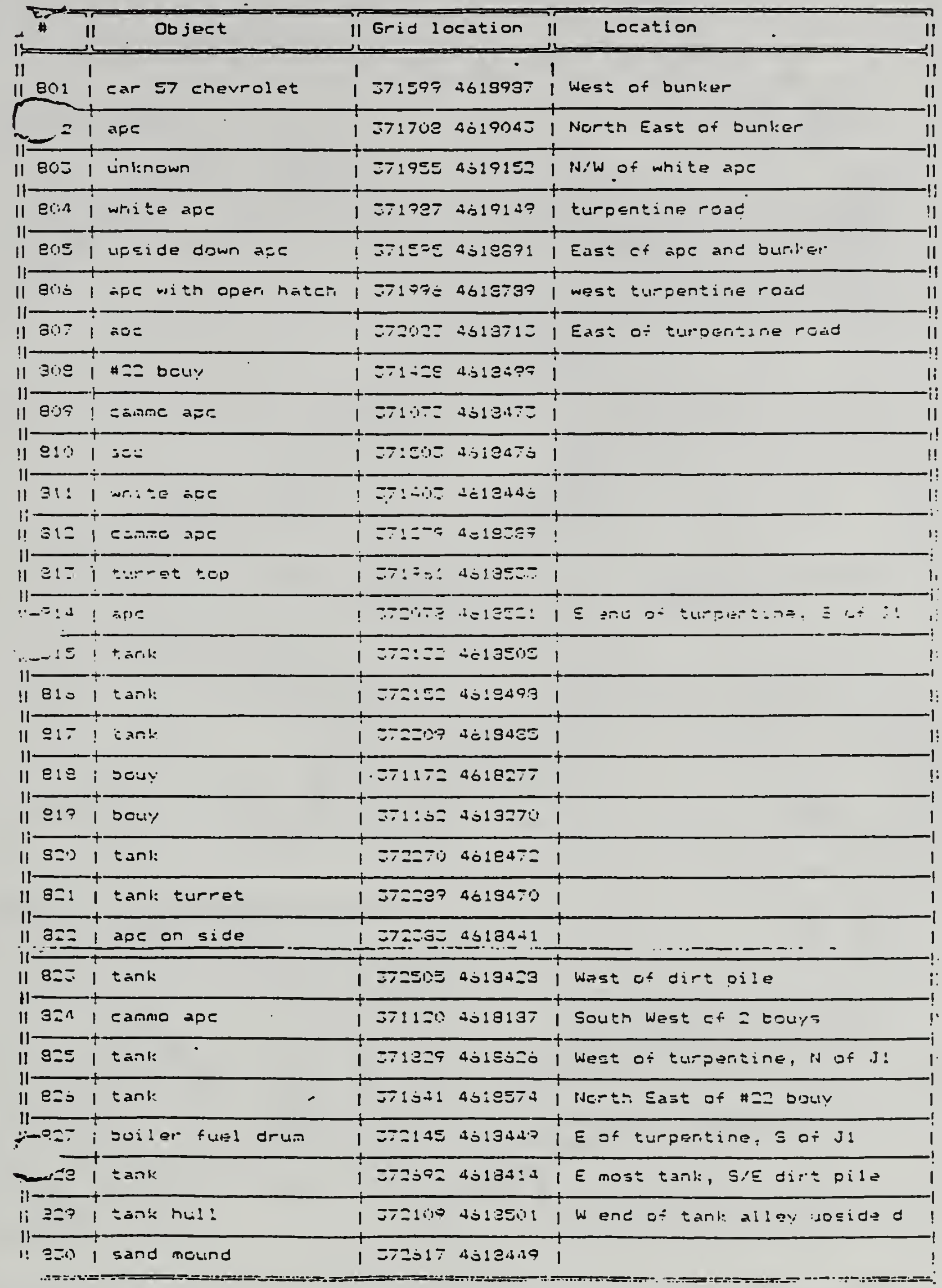


● Subsample

○ Discrete subsample

↔ Radius of Sample Ring from the center of Target

Attachment A: Target List and Map from Range Control



#	Object	Grid location	Location
801	car 57 chevrolet	371599 4618937	West of bunker
2	apc	371708 4619043	North East of bunker
803	unknown	371955 4619152	N/W of white apc
804	white apc	371987 4619149	turpentine road
805	upside down apc	371595 4618891	East of apc and bunker
806	apc with open hatch	371996 4618739	west turpentine road
807	apc	372023 4618713	East of turpentine road
808	#22 bouy	371428 4618499	
809	cammo apc	371073 4618473	
810	apc	371503 4618476	
811	white apc	371403 4618446	
812	cammo apc	371279 4618389	
813	turret top	371961 4618503	
814	apc	372073 4618521	E end of turpentine, S of J1
15	tank	372122 4618505	
816	tank	372152 4618493	
817	tank	372209 4618485	
818	bouy	371172 4618277	
819	bouy	371162 4618270	
820	tank	372270 4618472	
821	tank turret	372239 4618470	
822	apc on side	372263 4618441	
823	tank	372505 4618423	West of dirt pile
824	cammo apc	371120 4618137	South West of 2 bouys
825	tank	371329 4618626	West of turpentine, N of J1
826	tank	371641 4618574	North East of #22 bouy
827	boiler fuel drum	372145 4618449	E of turpentine, S of J1
28	tank	372692 4618414	E most tank, S/E dirt pile
829	tank hull	372109 4618501	W end of tank alley upside d
830	sand mound	372617 4618449	

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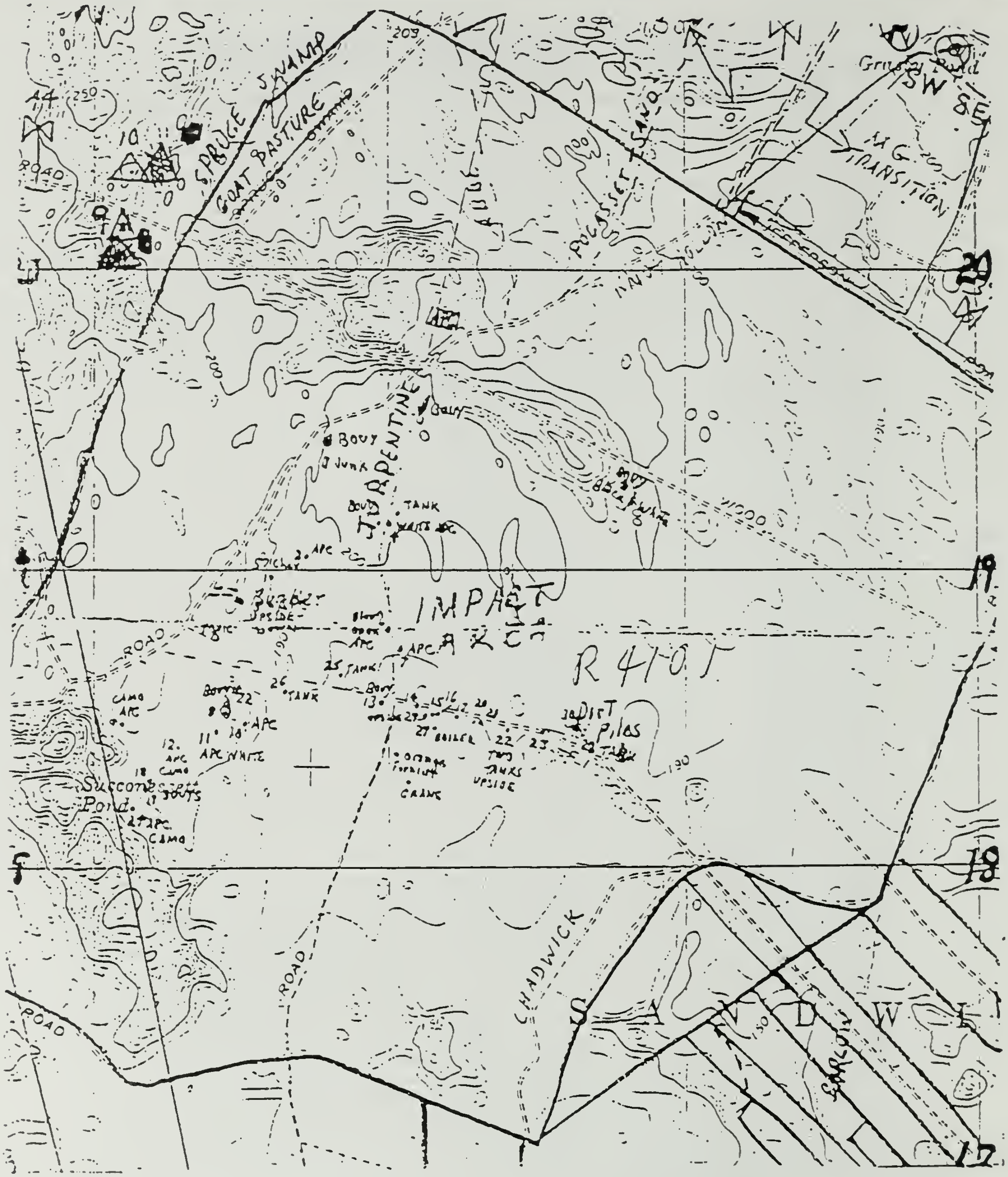

ATTACHMENT B: FIELD GUIDE TO HIGH EXPLOSIVES

Any substance encountered during sampling activities which differs in any way from natural media will be treated as a dangerous substance, carefully removed from the sample, and set aside.

EXPLOSIVES

NAME	DESCRIPTION	REMARKS
BLACK POWDER	BROWN TO BLACK	MANUFACTURED IN GRAINS THAT RANGE IN SIZE FROM SMALLER THAN SALT GRAINS TO GRAINS AS LARGE AS SMALL PEBBLES. HIGHLY SENSITIVE TO IGNITION BY HEAT, FRICTION, FLAME, SPARK. WHEN WET, IT IS CORROSIVE TO MOST METALS.
TNT	LIGHT YELLOW TO BROWN OR GRAY	LIGHTLY CORROSIVE WITH LEAD. USED IN BOMBS, GRENADES, DEMOLITION CHARGES, PROJECTILES. EXUDES AT ELEVATED TEMPERATURES. MODERATELY TOXIC BY SKIN ABSORPTION OR INHALATION.
EXPLOSIVE D	BRIGHT YELLOW TO ORANGE. ALSO CALLED AMMONIUM PICRATE.	RELATIVELY INSENSITIVE. HIGHLY TOXIC BY INHALATION, INGESTION, OR SKIN ABSORPTION
AMATOL	LIGHT BROWN TO YELLOW/MIXTURE OF TNT AND EXPLOSIVE D	SLIGHT HYGROSCOPIC. HAS CORROSIVE EFFECTS ON COPPER, BRONZE, LEAD, BRASS. HIGHLY TOXIC BY INHALATION, SKIN CONTACT, INGESTION.
COMPOSITION B	WHITE TO BROWNISH YELLOW, MIXTURE OF TNT AND EXPLOSIVE D	SLIGHTLY CORRODES COPPER, BRASS, CADMIUM, ZINC. USED IN BOMBS, PROJECTILES, GRENADES, SHAPED CHARGES.
OCTOL	LIGHT BROWN	USED IN BOMBS, PROJECTILES, SHAPED CHARGES.
RDX	WHITE. ALSO CALLED CYCLONITE	SENSITIVE TO IMPACT AND FRICTION.SLIGHTLY CORROSIVE WITH COPPER, BRASS, MILD STEEL, CADMIUM. MODERATELY TOXIC BY INHALATION OR INGESTION.
HMX	WHITE. ALSO CALLED OCTOGEN	SENSITIVE TO IMPACT AND FRICTION. SLIGHTLY TOXIC.
PETN	WHITE	SENSITIVE TO IMPACT. SLIGHTLY CORROSIVE TO BRASS, CADMIUM, ZINC. VERY SLIGHTLY TOXIC.

EXPLOSIVES, continued

NAME	DESCRIPTION	REMARKS
LEAD AZIDE	WHITE TO LIGHT BROWN	VERY SENSITIVE TO IMPACT, FRICTION, SPARKS. CORROSIVE TO COPPER, ZINC. VERY SLIGHTLY TOXIC.
LEAD STYPHNATE	LIGHT ORANGE TO REDDISH BROWN	SAME AS LEAD AZIDE.
MERCURY FULMINATE	GRAYISH	VERY SENSITIVE TO IMPACT, FRICTION, SPARKS. CORROSIVE TO ALUMINUM, MAGNESIUM, BRONZE, COPPER, ZINC, BRASS. HIGHLY TOXIC THROUGH SKIN ABSORPTION, INHALATION, INGESTION. SYMPTOMS RESEMBLE MERCURY POISONING.

PYROTECHNIC AGENTS USED AT MMR

SYMBOL	COMMON NAME	VISUAL IDENTIFICATION	ACTION
CS	NONE	WHITE CRYSTALLINE SOLID	TEAR AGENT
HC	HEXACHORO-ETHANE	WHITE SOLID	SCREENING SMOKE
WP	WHITE PHOSPHOROUS	PALE YELLOW SOLID	SCREEN SMOKE AND INCENDIARY
RP	RED PHOSPHOROUS	REDDISH BROWN POWDER	SCREENING SMOKE

OTHER COMPOUNDS

NAME	PROPERTIES	STABILITY
Picric Acid	lemon-yellow crystalline solid	very sensitive to blows or friction
Tetryl	fine yellow crystalline powder	sensitive to blows or friction
Composition A	white, >90% RDX	very sensitive to blows or friction
Composition C3	unknown	unknown
Composition C4	white, >90% RDX	very sensitive to blows or friction
Pentolite (50/50)	yellow-white, TNT/PETN	unknown
Tracer Compound	Potassium perchlorate	unknown
PBX	Plastic Bonded Explosive	unknown
Ednatol	yellow cast explosive, EDNA/TNT	medium sensitivity
Tetrytol	light yellow to buff, TNT/Tetryl	sensitivity > than TNT, < tetryl

Attachment C. Soil Sampling Protocol

Sampling for all Phase I Analytes

- The split barrel sampler will be decontaminated following the procedures outlined in SOP "MMR TECH-036".
- The split barrel sampler will be hammered to the desired depth using the slide hammer.
- The sampler will be retracted from the hole and detached from the hammer.
- The core tip and hammer cap will be unscrewed from the split tube.
- The split tube will be opened and samples will be transferred to a headspace container and a decontaminated stainless steel bowl for preparation of composite samples.
- The split barrel sampler will be decontaminated prior to the collection of additional samples.
- If refusal is encountered with the split barrel sampler, an attempt to collect the sample with a hand auger will be made.
- The split barrel sampler will be used for the collection of laboratory samples only. If there is an interval in the boring that will not be laboratory analyzed, then that interval will be removed using a decontaminated hand auger.

Volatile organic compound sampling

The location for VOC sampling within the grid will be selected based on headspace measurements. After the soil from the desired interval has been collected as described above, the following procedure will be followed for VOC samples:

- Soil samples shall be collected using an open barrel, disposable syringe
- The syringe will be filled with approximately 5 grams of relatively undisturbed soil.
- The end of syringe barrel will be covered.
- The soil will be extruded into a tared, prepreserved VOA vial containing a stir bar, sodium bisulfate and distilled water. (These tared VOA vials are provided by the manufacturer).
- The VOA vial will be capped quickly and label with EPA IDs, date, and time of collection.
- Three VOA vials will be collected for each sampling location for analysis by Method OLM03.2 and three VOA vials for Method 8021 (MTBE and EDB).

- In the event that a field screening technique (instrument reading, visual staining of the soil, or olfactory observation) indicates the presence of VOCs or hydrocarbons, note the observations or instrument readings in the field logs. The sample shall be recollected following receipt of the laboratory results that indicate volatiles exceeding 200ppb (indicating a high level volatile analysis).
- If the sample is collected for high level volatile analysis, the sampling procedure will be the same with the exception that the sample shall be extruded into a VOA vial containing "Purge and Trap" grade methanol. (The VOA vials preserved with methanol shall be supplied by the laboratory as needed).
- DOT requirements for the shipping of methanol will be followed.

Attachment D. Regulatory Agency Comments and Responses on Draft FSP

EPA General Comments (11/2/99):

1. It appears that targets 8, 9, 10, and 11 have numerous 40mm grenades surrounding them. Will this affect NGB's ability to sample these targets? Please see Specific Comment No. 1.

See response to Specific Comment 1.

2. EPA requests that what appear to be several targets located to the west of Turpentine Road and south of MW-37 be investigated by NGB. If the vehicles and piles of scrap appear to have been used as targets, their investigation will be included as a supplement to this workplan. EPA requests the same (or greater) level of detail in the reconnaissance descriptions to determine whether or not these targets should be sampled.

After receiving the above comment, the vehicles and scrap in the area west of Turpentine Road and south of MW-37 were inspected on 11/10/99. Draft change pages for the FSP that describe these potential targets were provided to the regulatory agencies on 11/18/99. Figure 1 of the FSP has also been revised to show these potential targets, and is attached to this response.

EPA Specific Comments (11/2/99):

1. Page 2, First Paragraph – The second sentence states that "two of the targets were in an area heavily covered with the 40mm grenades making them too hazardous to approach without removal of vegetation . . .". Will the targets in this area be sampled as proposed, despite the apparent numerous UXO in this area. In addition, please include recently gathered information regarding the origin (weapon utilized, firing position, type of munition fired, number of rounds fired) of the "40mm grenades" in this area.

The area was judged by the UXO Contractor to be too hazardous to be approached by Ogden field staff during the August 1999 reconnaissance, because at that time the Contractor was conducting avoidance and the rounds were judged to be potential HE. The *area was heavily vegetated at the time, obscuring the ground surface and hampering the avoidance effort. On November 10, 1999, targets 8-11 were revisited with the UXO Contractor, this time with little leaf cover present. During this reconnaissance, the UXO Contractor indicated that the 40mm rounds appear to be training rounds. Section 1.1 of the FSP has been revised to include this information.*

During the UXO clearance activity prior to sampling the UXO Contractor (and EOD personnel if necessary) will provide a positive identification of the rounds. If all rounds are inert as appears likely from the recent reconnaissance, the area could be sampled as proposed. If HE rounds are present, access for sampling is the decision of the Guard and EOD.

The "MK 19 Safety Packet" for Mortar Position 8 was provided to the regulatory agencies on 11/18/99. This publication describes an alternate use of MP-8 for the MK 19 40mm grenade machine gun range. Two firing points were utilized, and the M918 TP (training) round was the only munition authorized for use. The sketch in this publication appears to show targets 1, 4-7, and 9-11 in use for this range.

2. Page 3, Target 4: APC and Target 5: Buoy – As stated in this paragraph and in the following paragraph, please be consistent in the manner in which UXO are referred to, as the type of ordnance located in the vicinity of each target is important (i.e. "Mortars and howitzers" versus "training rounds", are these "training rounds" mortar rounds or artillery rounds?) Please amend each target description for consistency.

The text will be revised as requested.

3. Page 4, Target 6: APC – The text states that "The inside of the APC contains many mortar rounds." Please include text discussing whether these rounds were from clearance activities, firing, were they training rounds, approximate number, etc.

The site reconnaissance involving Ogden field staff was not designed to collect the requested information. The UXO Contractor and/or EOD will obtain this information during the UXO clearance activity, prior to sampling.

4. Page 5, Section 2.0 – During whichever portion of the fieldwork NGB deems most suitable (UXO clearance or soil sampling), EPA requests that detailed notes be recorded regarding the type and approximate number of ordnance items located in the vicinity of the targets.

The requested information will be obtained during UXO clearance prior to sampling.

5. Page 5, Section 2.0 – EPA requests that an additional sample be considered for each target where the orientation and configuration of the target may justify the collection of a soil sample from beneath the target, or any overhang on the target. From the photographs and descriptions present in this sampling plan, it appears that the tank and APC targets may by the only ones which may have locations beneath them for residues to be protected from the effects of weathering. Based on information presented in this sampling plan, it appears this request may result in approximately 6 additional discrete samples.

The workplan will be revised to include additional samples from beneath targets. Final decision on the number and locations of these samples will be made following UXO clearance, through review of photographs or a site tour with the agencies.

6. Page 7, Section 3.0 – EPA questions the proposed number and location of the groundwater monitoring wells. The text states that of three monitoring wells in the vicinity of the mortar targets, the only detection of explosives was in a shallow screen in a well located 6 feet from a target (MW-25S); why then is PMT-1 proposed to be placed so close to MW-9, a downgradient monitoring well with no explosive detections? When discussing wells such as MW-9 and MW-15, please include more information regarding the installation of the monitoring wells (i.e. was groundwater profiled at these locations?, What depth is the well screen at MW-9?, What depth are the well screens at MW-15?)

The text will be revised as requested, to include the additional information discussed at the technical meetings on 11/4/99 and 11/18/99, and emailed to the regulatory agencies on 11/8/99.

> What is the feasibility of placing a two-screen monitoring well immediately downgradient of Targets 9 and 10? This well, in addition to a three-screen well located along Pocasset Sandwich Road as proposed, would allow the IAGS to more effectively characterize this general target area.

This location would require building about 1000 feet of roadway from MW-8. As discussed with the regulatory agencies on 11/18/99, the FSP will be revised to include a second monitoring well (PMT-2), which may be located near Targets 9 & 10 or at another location *downgradient from any detections in the proposed soil samples.*

7. Pages 15 and 16, Attachment B – Under the "Other Compounds" heading on page 16, it appears that more information is available than is listed in the table. The properties and stability of C-4 are not known? The properties and stability of Pentolite are also available. This table should be reviewed and updated.

The text will be revised as requested.

MADEP Page-Specific Comments (11/9/99)

Page 2, Table 1. **Mortar Types and Locations**

Table 1. of the FSP lists 11 of a total of 30 mortar targets surveyed during field reconnaissance. It is the Department's understanding that this FSP represents the first phase of sampling at Mortar targets. Please confirm.

As indicated in the first paragraph on page 1, the 19 other targets listed by Range Control are primarily located along Tank Alley and Turpentine Roads. Sampling around these targets was conducted during Phase I of the IAGS, and has continued under Phase II (a) for a few of these targets. No sampling of these targets is proposed in the current FSP.

The Department also understands that Target #3 has already been proposed for sampling within the Phase II(b) Workplan (Ogden, 1999). In addition, one target was not found (Tank at Target #2), and two others (APC Target # 8 and APC Target # 11) were not subjected to a closer reconnaissance because they were in an area heavily overgrown with vegetation, as well as strewn with 40 mm grenades, making approach too dangerous due to the presence of UXO. The text of the FSP is not clear on whether Targets #3, #8, and #11 have been omitted from further consideration, or whether vegetative and UXO clearance will be performed to allow for soil sampling a these three locations. Please revise the text to clarify.

Page 6 of the FSP indicates that no further sampling is proposed for target 3. The text on page 5 will be revised to indicate that all targets in Table 1 will be sampled, except for target 2 that was not found by reconnaissance. See response to EPA Specific Comment 1 regarding UXO clearance.

Page 7, **Section 3.0 Proposed Groundwater Investigation**

The Department concurs with the NGB's approach to drilling, and accepts well location PMT-1 with the understanding that additional wells may be required following review of soil data. Please also note that wells installed pursuant to the NGB's September 23, 1999 **Phase II(a) Response Plan for Impact Area RDX Detection in Groundwater** (the "RDX Response Plan") may also provide additional data that will indicate the necessity of additional wells to better characterize impacts of the mortar targets on groundwater quality. Please confirm that the schedules for both RDX Response Plan wells and soils data from the mortar targets investigations will be sufficiently integrated that the NGB, with input from the regulatory agencies, will be able to expeditiously make this determination.

The preliminary schedule for the mortar targets is to complete soil sampling by February 2000, and install wells in March-April 2000. These two activities are scheduled sequentially so that the results from soil sampling can be used to guide the installation of wells.

The preliminary schedule for the RDX Response Plan wells is to conduct drilling and profiling during the period of January to May 2000. Therefore, there is overlap in the two investigation schedules. The Guard will work closely with the regulatory agencies to ensure that results from both investigations are considered in an integrated evaluation of groundwater quality in the Impact Area.

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